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ABSTRACT

Before purchasing computer hardware, individuals must consider the costs associated with the setup and operation of a microcomputer system. Included among the initial costs of purchasing a computer are the costs of the computer, one or more disk drives, a monitor, and a printer as well as the costs of such optional peripheral devices as a plotter and modem. Hidden costs involved in setting up a computer system include the cost of furniture (a computer desk and printer stand); electrical equipment and circuitry (static electricity, a surge protector, multiple outlets, and a dedicated circuit); and special telephone equipment (special cords, connectors, and lines); and software. Other items that are either desirable or necessary to maintaining a computer system include protective covers, documentation, blank disks, disk storage devices, a head cleaner, paper, printer ribbon, plotter ink and cleaner, and service contract. Depending on which optional items a consumer elects to purchase, these setup and maintenance costs can add from tens to hundreds of dollars to the initial cost of purchasing a microcomputer. (MN)

THE HIDDEN COSTS OF OWNING A MICROCOMPUTER

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Newspapers and magazines contain numerous advertisements selling microcomputer systems for home and office. Microcomputer systems -- computer, disk drive, and monitor -- which offer sophisticated computing capability are available for under $2000. For a few hundred dollars more, a printer can be added. Competition is stiff for the hardware dollar, and consequently, manufacturers are lowering prices and dealers are willing to sell systems at low mark-ups. The best pricing is obtained for complete systems where the hardware and software are "bundled" into a package. The obvious advantage is that powerful computing/word processing is available for what appears to be a relatively modest investment. Beware! The outflow of dollars to make the system operational has just begun.

Some unexpected costs are associated with the set-up and operation of a microcomputer system. Rarely, however, are these costs mentioned, let alone detailed, when purchasing the hardware. They are hidden from view until discovered during the set-up and use of the system where they can add considerable (possibly, ultimately, hundreds of dollars) to the cost and operation of the system.

These hidden costs fall into two categories, set-up/start-up costs and operational costs, as shown in the following List of Costs Associated With Owning a Microcomputer. The set-up/start-up costs include those hidden items necessary to make the system work. Some of the items listed in the column "Hidden Costs" are mandatory, others are optional but desirable, in getting the system going. The operational costs are the reoccurring costs necessary to keep the system working.

Costs Associated With Owning a Microcomputer

Initial Purchase Costs	Hidden Costs
Basic System	Furniture
Computer	"Computer" desk
Disk drive	Printer stand
Monitor	Electrical requirements
Printer	Static electricity
	Surge protector
Optional Peripheral Devices	Multiple outlets
Plotter	Dedicated circuit
Modem	Telephone communication (special connectors, cords, line)
	Protective covers
	Software
	Documentation (books, magazines, etc.)
	Blank disks
	Disk storage devices
	Head cleaner
	Paper
	Printer
	Plotter
	Printer ribbon
	Plotter ink(s) and cleaner
	Service contract/Service

The first start-up cost may well be the answer to the question "Where will you put the computer?". Unless you intend to take the computer out and put it away at each session, the system needs a permanent home. Usually this home is a desk. However, not just any desk will do, as the standard desk places the keyboard above the ideal height of about 26 inches. Anything higher than 26 inches is too high for comfort. Special "computer" desks, which will hold most of the hardware items, are available at a cost of from $50.00 to $250.00. A separate printer stand may also be desirable (at an extra cost).

Placement of the computer in the room is dictated by other than aesthetics. Illumination and glare are major considerations according to Ecstein [1], as improper light (from natural and/or artificial sources) leads to eyestrain, visual and muscle fatigue. Placement under a window is undesirable as the contrast between the bright window light and the dimmer screen leads to squinting and eyestrain. The

reflection of room light causes glare on the screen. It may be necessary to control both the ambient light (using window shades, relocation of lights) and the placement and contrast of the video display (by using optional devices or filters) to achieve optimum viewing/working conditions.

Static electricity, computers and magnetic storage medium do not mix. Static electricity discharges can either destroy the micro-circuits or place undesirable signals on the magnetic storage devices (disks, etc.). Two methods are available to control static electricity. Either humidification of the atmosphere in the room or the use of special anti-static (conductive) floor covering will eliminate the problem.

Before you plug in the system, the computer's electrical requirements must be considered. Not that the equipment draws high current, but that the computer is sensitive to electrical voltage shifts and surges. A surge protection device is a wise investment as it prevents problems associated with line voltage fluctuations. The usual cost is between $25.00 and $100.00

While the computer will work when plugged into any outlet, a separate electrical circuit, dedicated to the system, is advised. Power failure is serious, not necessarily to the equipment, but to the data and operations being performed. Anything that is in RAM (Random Access Memory) and not saved permanently on disk is lost when the power flow is interrupted. Even a momentary loss of power is fatal. Just try turning off the power switch and then back on. Disaster! If the computer shares the circuit with another appliance or device, the potential for power interruption exists should any other device on the line cause the fuse to blow. Stevens Institute of Technology, after requiring all students to own a microcomputer, found it necessary to re-wire all dormitory rooms to prevent power interruptions caused by equipment failure in other rooms [2]. Thus, each computer should have its own separate circuit. While the electrician is wiring in that extra circuit, have enough outlets installed to accomodate the power cords of the separate components, as each device comes with its own power cord. An alternative to extra outlets is to use an extension cord with a multiple outlet strip. Strips with a master switch are handy as one switch controls the entire system. Also, some power strips come with built-in surge protectors.

If you are planning on using a modem, a telephone line must be nearby. If the line usage is heavy (either by the computer or by the telephone users), you may want to have a separate line installed just for the computer (an added expense for the installation, telephone set, and monthly line charges). If high grade communications are required, a special computer grade line can be installed and maintained -- at considerable expense. Special telephone connectors and cords may be required.

Computers are sensitive to dust and dirt. The purchase of protective covers may be a wise investment, particularly if the computer is in a location where there is considerable airborne dust. Food, smoke, dust, and almost anything else can be fatal to the computer system, particularly the disk drive. Head clearances in the drive are small, and dirt (even cigarette smoke) caught under the head can scratch the disk. Convection and fan-forced cooling draw smoke and dust into the computer where the pollutants accumulate on components and hinder vital cooling functions [3]. Thus, a change of work habits is mandatory. No food, drink, smoke, dust, etc. nearby.

The advertised price of the hardware usually does not include the cost of the software. Depending upon the application and the computer system, word processing software costs between $50.00 and $350.00 and spread sheet software between $100.00 and $500.00. Other types of software average in cost between $25.00 and $100.00. Unless the computer and software are purchased as a package and used only as a dedicated pair, the purchase of other software will undoubtly be desired.

The documentation that accompanies most hardware and software frequently leaves something to be desired. Manufacturer produced documentation may not be sufficient to answer all your questions. Therefore, the purchase of additional documentation, periodicals, and/or training materials and programs from third party vendors is usually desirable. There is no shortage of additional documentation, but check its quality. It can be expensive.

Blank disks will be required for the storage of data and programs developed in the course of using the computer. A second use of disks is in the creation of back-up copies of software and data. Due to the probable failure of disks, only a computer illiterate fails to make back-up copies of program and data disks. The originals are stored in a safe

place, and the copies are used on a daily basis. A formula for determining the number of blank disks to purchase is: one blank disk for each purchased program disk; two blank disks for each user prepared program and/or data storage use. Therefore, every disk has a back-up at a cost of from $2.00 to $7.00 per disk.

In active computer use, several disks will be acquired. Safe storage for these disks is necessary. Special disk storage systems (envelopes, notebooks, trays, or boxes) can be used to properly store and protect the disks. Since a duplicate set of storage devices is necessary -- one storage system for the active disks and a second storage system for the original disks. Incidentally, the original disks should be stored in a safe place, away from the computer system and any source of a magnetic field. Thus, if there is damage to the active disks, the originals will be protected. Disk storage devices cost between $10.00 and $25.00 each, and frequently hold a maximum of 10 disks.

The other major accessory for the disk drive is a head cleaner. Disk drives are magnetic recording devices and, like tape recorders, require periodic cleaning. Special head cleaning disks and solutions are available. Purchase the type that is specifically designed for your disk drive. The cost is between $7.00 and $25.00.

Routing the output to the printer produces hard copy. Computer paper is necessary if the computer is used for word processing, the production of reports, or for copies of programs or results. Printers are paper hungry and can use an incredible quantity of paper in a short period of time. Paper is expensive and generally cannot be reused. Unlike the typewriter, where a mistake can be corrected immediately on the typed page, a computer produced document containing an error is usually reprinted. Also, many people find it easier to proofread and make changes on printed copy than on video-displayed material. Therefore, several drafts may be printed before the final copy is run. All this activity causes the printer to chew up paper at a fantastic rate. Depending upon the quantity and quality of paper purchased, the cost per sheet can run from $0.005 to $0.04 per sheet. Keeping two types of paper on hand, better quality for correspondence and inexpensive for general purpose use, helps contain the cost.

Paper is not the only expense in owning a printer. The replacement cost of the ribbon for the printer is usually not mentioned when the printer is purchased. However, ribbons do not last forever and their replacement cost can be significant. One of the decisions when purchasing a printer should be the replacement cost of the ribbon. Ribbons can cost from between $2.00 and $30.00. More than one ribbon may be desired, particularly if the printer is used for both production work and correspondence, as a change can be made to a better ribbon when the nature of the work requires it.

If you have a plotter, keep in mind the costs of special plotter paper, ink(s) and cleaners.

Service will be necessary -- ultimately. Computers are complex interconnections of several pieces of sophisticated electronic and electro-mechanical (printer, disk drive) devices which are failure prone. A service contract insures "no service call fees" but comes with a yearly purchase cost. The other way is to pay for service as needed. Typical service charges are between $50.00 and $150.00 per hour.

As with any major purchase, there are two cost categories -- (1) the initial purchase price of the equipment (hardware) and, (2) the cost of operation (software and supplies). Investigation into the purchase of a system should include both the cost of the machine as well as the cost of the set-up, materials and supplies necessary to operate it. In the case of the computer, these set-up and operating costs can add anywhere from tens of dollars to hundreds of dollars to the initial purchase price.

NOTES:

1. "Many Here Says 'Yes!'." An Interview with Enid Ecstein, Southeast Michigan Coalition for Occupational Safety and Health. The Ann Arbor News, Sunday, April 1, 1984.

2. "Notes on Computers". The Chronicle of Higher Education. October 12, 1983. Pg. 25.

3. Popular Computing, June, 1984. Pg. 18.

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